Investigation of Prosthetic Joint Infection of the Knee - The Exeter approach to this challenging condition

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The Exeter Knee Infection MDT and collaborative working

The investigation and management of prosthetic joint infection (PJI) is a clinical challenge that requires the application of surgical, medical and microbiological knowledge and experience. Despite improvements in the understanding of PJI, clinical outcomes remain reasonably poor and the mortality rate is higher than in many common cancers. Patients present in a spectrum of ways; from the stable patient with the quiet sinus through to the patient in extremis requiring emergency management.

What has become abundantly clear is that a single person within a unit managing all of the infections or complex cases is no longer appropriate[1]. A team approach is preferred. PJI cases are complex, frequently requiring anaesthetic, ITU, pharmacological and rehabilitation team input as well as microbiological and surgical expertise.

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A Multi-Disciplinary Team (MDT) approach is now accepted as the appropriate standard of care for patient with PJI[1]. The Exeter knee infection MDT was established in 2015 to discuss all cases of native or prosthetic joint infections around the knee[2]. Hip and knee teams in Exeter work independent of each other, so separate meetings were established. The precedence of cancer MDTs for decision making in complex clinical cases has made a robust argument for MDT working in cases of PJI[3-5].

In our experience, establishing the MDT was one of the biggest challenges[6]. Negotiating and aligning the various invested parties job plans was difficult. An appropriate time of the week was identified (once every two weeks), with access to hospital MDT facilities (multi-screen functions with video sharing; Figure 1). Appropriate personnel were assembled (orthopaedic revision knee, microbiology, pharmacy with plastic surgery available if required). Colleagues at neighbouring units would dial-in or ask for advice, and on occasion local colleagues would ask for advice on shoulder or ankle PJI cases.

We published qualitative findings that demonstrated that team members thought MDT working was an improvement in patient care, and the MDT has continued in its current form to the present day[6]. Figure 2 is a Word Map illustrating the most commonly transcribed

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Figure 1: The Exeter Knee Infection MDT.

words associated with interviews about the MDT[6]. The benefits of a formalised MDT have meant improvement in documentation, communication and continuity of care. This is well supported by the published literature on MDT working improving the outcomes for complex conditions. Orthopaedic infection MDTs have now become well established throughout the UK[1,7,8].

The establishment of our MDT has enabled protocolised care of PJI at our unit, which, in turn has led to research and educational opportunities. Exeter had representation at the ICM Philly Consensus meeting in 2018, which in turn led to the formation of the UK PJI group[9]. Our unit has collaborated with colleagues from Bristol and Oxford in establishing priority setting for revision knee surgery with the James Lind Alliance Priority Setting Partnerships[10,11]. As a direct result of this patient-clinician consultation, investigation and management of PJI has now been demonstrated as one of the key areas for research for knee surgery in the UK, enabling researchers the ability to access better levels of funding for research into PJI[10].

We are collaborating with Exeter university and are leading an NIHR multicentre RCT on the treatment of PJI (MIKROBE study single vs two stage in the management of knee PJI)[12]. Our work on infection has also led to a number of publications on knee infection, its diagnosis and management over recent years[6, 13-20]. Through this collaborative work and future work planned we hope that this may lead to improvements in patient outcomes over time.

In 2018 the Revision Knee Working Group (RKWG), consisting of a group of high volume revision knee surgeons was established through BASK. This team, chaired by Exeter surgeon Professor Andrew Toms, has been responsible for the restructuring of revision knee surgery and infection treatment of knee PJI in the UK, and the development of a 'Good Practice Guide' to revision knee surgery.

One of the many outputs of the RKWG was a BOAST on 'Investigation and Management of Prosthetic Join Infection in Knee Replacement'. This document presents appropriate diagnostic and management for PJI, as well as discussing the recommended organisational and administrative requirements to treat PJI.

Figure 2: Word Map: Fifty most mentioned words in the interviews about Exeter MDT.

Investigation of knee prosthetic joint infection

There are well-established criteria to define PJI (ICM 2013, 2018, EBJIS 2021). There are many similarities between these criteria, with subtle differences in the scoring and methods used to define PJI. All define a PJI with the major criteria as either two separately collected samples confirming the same organism, or the presence of a sinus. The minor criteria and scoring systems differ between. The BOAST recommended use of the ICM 2013 criteria[1].

The investigation and management alters, depending upon the type of presentation of the patient. Patients who present with evidence of systemic sepsis require urgent assessment and intervention[13]. It is appropriate to start antibiotics immediately, to contact the ITU team and to organise surgery to reduce the septic load, which in these cases is appropriate usually to perform arthroscopically. Samples should be processed urgently by the laboratory and broad-spectrum antibiotics should be started if not done already. These patients can then be passed onto the specialist team the following day to continue care.

Most patients do not present with systemic sepsis. For these, the investigation for PJI starts with a detailed history and examination. Any previous perioperative problems or potential sources of infection should be reviewed. A medical and drug history is required to look for immunocompromise or impact on treatment options. Radiographs are required in all cases to ensure the implants are stable, and blood test inflammatory markers (CRP, full blood count and either ESR or plasma viscosity) should be performed. The routine use of more advanced imaging is not routinely recommended unless in specialist centres.

Inflammatory blood marker results that are low (a threshold of ESR > 30 mm/hr and CRP > 10mg/L is recommended for chronic PJI), alongside a low clinical suspicion makes the diagnosis of PJI less likely.

Where the level of clinical suspicion is high, especially when inflammatory markers are raised, further investigation is recommended to define the presence of PJI and to importantly identify the infective organism(s). We believe that identification of the organism(s) is the key piece of the puzzle as it significantly impacts planning further treatment options and decision making. For surgeons unfamiliar with the diagnosis and treatment of PJI, we would recommend referral to a unit with an Infection MDT to further investigate these cases. The UK is now in the process of developing clearly defined clinical networks within each region to manage these cases[17].

Prior to taking samples from the joint, all antibiotics should be stopped for a two-week window to maximise the chance of identifying the organism. Aspiration of the joint should be performed aseptically in a clean environment such as a clean clinic room or operating theatre. A cell count should be performed on the fluid, alongside additional tests dependent on local policy in line with the ICM criteria.

It is our preference in Exeter to proceed with an arthroscopic biopsy (usually blind unless other diagnoses are considered) under anaesthetic, rather than an aspiration, to identify the organism. Currently unpublished data collected at our unit has demonstrated that multiple tissue samples provide more information than aspiration alone. Any biopsy procedure should collect five samples using different sampling sets for urgent evaluation. Histological examination with a quantitative assessment of neutrophil infiltrates is also recommended if the facilities are available.

For cases highly suspicious for infection where negative culture results are obtained, further discussion at the Infection MDT and investigation is recommended. A high index for suspicion is required for multiply-revised cases or cases previously treated for infection. Consideration of additional fungal, mycobacterial and/or molecular testing may be performed alongside taking repeated samples.

It is then our aim to discuss all cases at both our Infection and Revision Knee MDT meetings prior to performing surgery. Cases are presented to colleagues and advice and guidance is often offered and gratefully received. This provides us the opportunity to plan the type of surgery (single vs two-stage), and the surgical equipment and implants. All patients are classified using the RKCC complexity classification system[15].

Finally, all patients have a formal 'Proforma' completed ahead of surgery with the microbiologist. This details the organism, the resistance and sensitivity pattern, along with antibiotics that will be required on induction of the anaesthetic, to go into the cement and to be given post-operatively. Our orthopaedic pharmacist is then able to order the antibiotics ready for the date of surgery.

We believe that our method for investigating and managing infection through protocol and team working leads to a more streamlined and organised approach to managing PJI, offering the best chance of a good outcome for patients with this awful condition. ■

References

References can be found online at: www.boa.ac.uk/publications/JTO.